

WHAT IS CLAIMED IS:

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1 1. A method for adjusting the resonant frequency of an acoustic resonator
2 comprising the steps of:
3 identifying an electrode-piezoelectric stack having an off-target
4 resonant frequency, said electrode-piezoelectric stack having conductive
5 electrode layers; and
6 oxidizing at least one of said conductive electrode layers of said
7 electrode-piezoelectric stack so as to achieve a target resonant frequency
8 that is dissimilar from said off-target resonant frequency, including intention-
9 ally inducing oxidation by exposing said at least one conductive electrode
10 layer to an oxidizing environment.

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1 ① 2. The method of claim 1 wherein said step of oxidizing includes thermally
2 oxidizing said at least one conductive electrode layer of said electrode-
3 piezoelectric stack by exposing said electrode-piezoelectric stack to an
4 oxidation-inducing environment at an elevated temperature.

1 ① 3. The method of claim 2 wherein said step of thermally oxidizing includes
2 exposing a top electrode layer of said conductive electrode layers to said
3 oxidation-inducing environment at said elevated temperature.

1 ① 4. The method of claim 3 wherein said step of thermally oxidizing includes
2 exposing a top surface of said top electrode layer to said oxidation-inducing
3 environment at said elevated temperature, said oxidizing being limited to a top
4 region of said top electrode.

1 ① 5. The method of claim 1 wherein said step of oxidizing includes providing
2 said oxidizing environment as air.

103 ① 6. The method of claim 1 wherein said step of oxidizing includes forming
2 said oxidizing environment within a rapid thermal annealer (RTA).

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1 ⑨ 14. The method of claim 9 wherein said step of intentionally inducing
2 oxidation includes exposing said upper portion of said top electrode within a
3 rapid thermal annealer (RTA).

⑨ 1 15. A film bulk acoustic resonator (FBAR) comprising:
2 a substrate;
3 a bottom electrode above said substrate;
4 a piezoelectric layer above said bottom electrode; and
5 a top electrode having an upper region above said piezoelectric
6 layer, said upper region including metal oxide, at least a portion of said metal
7 oxide being realized by an elevated temperature that is higher than the
8 ambient temperature;
9 wherein said FBAR having said portion of metal oxide has a
10 resonant frequency that is substantially closer to a target resonant frequency
11 than said FBAR without said portion of metal oxide.

1 ⑨ 16. The FBAR of claim 15 wherein said top electrode has a thickness that
2 is greater than a comparable electrode without said portion of metal oxide
3 being realized by said elevated temperature that is higher than said ambient
4 temperature.

1 ⑨ 17. The FBAR of claim 15 wherein said ambient temperature is room
2 temperature.

1 ⑨ 18. The FBAR of claim 15 wherein said top and bottom electrodes and
2 said piezoelectric layer form an element of an FBAR array.

1 ⑨ 19. The FBAR of claim 15 wherein said top and bottom electrodes and
2 said piezoelectric layer form an element of a passband filter.

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- 1 9 20. The FBAR of claim 19 wherein said resonant frequency is compatible
2 with operation in a code division multiple access (CDMA) personal communi-
3 cation system (PCS).

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099
1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	